

ON *ICTIDOSUCHUS PRIMÆVUS*.

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(Plates XXVI., XXVII.)

Some months ago I was fortunate in discovering on the farm of Mr. J. Krüger, in the neighbourhood of Pearston, the remains of a very interesting Theriodont. The coracoid and precoracoid bones were seen exposed on the hard shale which formed the bed of a small creek. On digging into the rock I found within a space of less than a square foot a considerable number of other bones. Unfortunately the bones have been disconnected and confusedly huddled together, so that it has been a matter of considerable difficulty to expose one bone without badly injuring another which lies across it, and the difficulty has been rendered the greater by the hardness of the rock and the brittleness of the bones. Though much of the skeleton is missing, I have succeeded in discovering, besides the bones of the shoulder girdle, not only a humerus, a radius, a femur, a tibia and a fibula, but also a fairly complete lower jaw and the greater part of the skull.

The discovery is interesting, not only in making known a new type of Theriodont skull, but also in having the principal bones of the skeleton found in association with it.

For the new form I have proposed the name *Ictidosuchus primævus*.

SKULL.

The skull is very imperfectly preserved, and had manifestly been broken at the time the remains were originally deposited, as the right maxillary region was found quite away from the greater part of the skull and no trace of the snout has been found except a small fragment. Fortunately sufficient of the skull has been found to give not only a good idea of the proportions, but also to show most of the external characters. The left side, with the exception of the snout, is fairly complete, and of the right side there is preserved in

apposition the larger portion of the squamosal, and though the whole is slightly distorted it is not difficult to restore it to its original shape.

As is the case in many Theriodonts and most Anomodonts, the skull is large in proportion to the limb bones, but is characterised by the slowness of its build and the slenderness of the arches.

The frontal region is moderately developed and is somewhat concave both antero-posteriorly and transversely. The frontal bones articulate in front with the prefrontals and presumably with the nasals. Behind they articulate with the postfrontals and parietals. Only a comparatively small part of the supraorbital ridge is formed by the frontals.

The postfrontal bone is of a remarkable form. It is shaped much like the letter "L"—the longer limb forming the postorbital arch and the shorter resting on the parietal ridge. The inner half of the postorbital arch is unusually deep, and being markedly concave on the anterior side, forms not only the posterior wall of the orbit, but, as a continuation of the supraorbital ridge, forms to some extent a roof. The outer part of the postorbital arch is very slender. The shorter limb of the postfrontal lies quite at right angles to the larger limb.

The parietal crest is narrow and deep. About midway between the inner end of the postorbital arch and the top of the occiput is a fairly large parietal foramen. The parietals pass for a considerable distance outwards from the hinder part of the crest and meet the squamosals.

The squamosal is a much more slender bone than in the Anomodonts, but is very similar in structure. Articulating above and internally with the parietal, it passes outwards and downwards—no doubt in contact with the supraoccipital and exoccipital—and sends forward a slender bar to meet the jugal and form the temporal arch. The greater part of the bone, however, descends as a bony plate—convex posteriorly—and no doubt gives articulation to the quadrate. The greater part of the squamosal is fairly well preserved on the right side of the skull.

In the anterior region of the skull most of the sutures are unrecognisable. The prefrontal is, however, readily distinguishable from the frontal. It seems to be rather a narrow element, though, as the suture between it and the lachrymal cannot be made out, it is impossible to say whether it or the lachrymal forms the larger part of the facial surface. It forms the anterior part of the supraorbital ridge.

The maxillary bone is well developed, and though it bears some

resemblance to the corresponding bone in previously known Theriodonts, it has a number of characters that are quite distinctive. The anterior dentigerous portion has a moderately flat surface and is even slightly concave at its lower border, but is remarkable by having numerous small irregular cuplike depressions, which give the bone a rough appearance at this part. The posterior non-dentigerous part, which is of moderate size, though showing very marked longitudinal striæ, has the surface of the bone smooth and even polished. The teeth comprise one large canine and a row of small simple molars. In the maxillary as preserved there are the remains of eight molars, and one is probably lost. Unfortunately the anterior three teeth are crushed backwards on the others, and of all the crowns are wanting. Fortunately in the detached right maxilla the crowns of three teeth are preserved, and show them to have been simple cones with the sides of the teeth ridged. The molars are all subequal in size. The canine is of relatively large size and directed mainly downwards. The fragment of maxilla which contains the root of the canine, though it cannot be fitted on to the larger portion of the maxilla, is figured in its exact relative position, the cast of the maxilla having fortunately been kept.

The jugal bone is a somewhat slender bone which probably forms the whole of the suborbital arch, and possibly a considerable portion of the temporal arch.

Of the palate it is impossible to speak with any degree of confidence. The little that remains in connection with the maxilla of each side is so crushed and imperfect that but a very unsatisfactory idea can be formed of the original condition. It may be regarded as moderately certain, however, that there is no distinct secondary palate such as is seen in *Cynognathus*. The maxillary only shows to a very small extent internal to the molar teeth, and joins what is apparently a forward extension of the palatine bone.

The lower jaw is fairly well preserved; almost the whole of the dentary element, with most of the teeth, having been found. It is characterised by the remarkable slenderness of the ramus and by the greatly developed coronoid process. In the large majority of Theriodonts hitherto discovered the lower jaw is a powerful bone with a deep symphysis. *Tribolodon*, however, agrees with *Ictidosuchus* in having a slender ramus, though the two genera are probably very dissimilar in most points of structure. In the jaw as preserved there are the remains of seven teeth, for the most part in good condition. They are all situated near the middle of the ramus, and, like the molar teeth above, are subequal in size. From the posterior third of the ramus teeth are undoubtedly absent, and from

the anterior fifth they are either absent or lost. Probably there have been some small incisors and a small canine such as is seen in the long slender jaw of *Perameles nasuta*, but no distinct indications of them remain. The jaw has been loosely articulated with its neighbour by a rather long symphysis somewhat similar to that seen in many Marsupials. The coronoid process is remarkably well developed, and is not only of great length, but is unusually thick. It forms an angle with the axis of the ramus of about 120° . The splenial appears to be only a feeble splint closely applied to the dentary. The articular is lost. The anterior of the teeth of the lower jaw are simple sharp conical teeth, very similar to those of the upper jaw, and, like them, ridged. The posterior four teeth are also very simple in structure, but have more rounded apices and are more feebly ridged.

In only a few of the many described Theriodont genera is the skull at all satisfactorily known; and in those the skull differs very considerably from that found in *Ictidosuchus*. In some of the higher Theriodonts, *e.g.*, *Gomphognathus*, the frontal bones are excluded from the orbits by the meeting of the prefrontals and postfrontals. In *Ictidosuchus*, as in *Dicynodon* and most Anomodonts, the frontals form a part of the supraorbital ridge. In the higher Theriodonts the parietal foramen is absent or rudimentary, though in *Galesaurus*, and probably the majority of lower Theriodonts, there is, as in *Ictidosuchus*, a well-developed parietal foramen. In the structure of the squamosal the affinities of *Ictidosuchus* are apparently more with the Anomodonts than with the majority of the Theriodonts. As regards the structure of the postorbital and temporal arches the condition in *Ictidosuchus* differs considerably from that in *Cynognathus* and is essentially similar to that in most Anomodonts. It is probable, however, that in most of the lower Theriodonts the structure of the arches is very similar to that in the Anomodonts. The lower jaw, so far as known, is thoroughly Theriodont in structure.

SHOULDER GIRDLE.

Of the shoulder girdle, the scapula, the coracoid, and the precoracoid of the left side are well preserved, and they present one or two characters in which they differ from those bones in the previously known South African forms. The scapula, though very broad at its base, is for the most part a long slender bone, with its axis so much curved that a tangent to the upper end of the bone would make with a tangent to the lower end an angle of about 100° . In the middle region the scapula is narrow and flattened, with a rounded

posterior and a sharp anterior border. As it passes upwards it gradually widens, and becomes at its upper end almost quite flat. The lower end of the scapula is unusually broad, and, with the exception of the low ridge which passes up from the glenoid cavity, almost quite flat. The lower border of this large anterior flat expansion articulates with the precoracoid. The acromion process is quite rudimentary. The glenoid surface of the scapula is of moderate size.

The coracoid is very similar to the coracoid in the Anomodonts, but has a rather larger glenoid cavity, and the posterior part is rather more developed.

The precoracoid differs considerably from that of the Anomodonts. It is a larger element proportionally than in the Dicynodont girdle, being very considerably larger than the coracoid. In its upper and posterior quarter there is a large oval foramen, which is completely formed by the precoracoid.

On the whole the shoulder girdle, so far as known, seems to be of a more primitive type than that of either the Anomodont or the higher Theriodont. In *Cynognathus* the scapula is much specialised, having a well-developed spine and a distinct acromion which projects outwards considerably from the general surface, and the precoracoid foramen is almost, but probably not altogether, surrounded by the precoracoid bone. In the Dicynodont type there is likewise a well-developed acromion; while the precoracoid foramen is in the upper border of the precoracoid and partly walled by the scapula. In the Russian genus *Rhopalodon* the scapula is moderately flat, and the acromion rudimentary as in *Ictidosuchus*, while there is a further agreement in the large development of the precoracoid and in the foramen being entirely in the precoracoid bone.

HUMERUS.

The humerus is fairly well preserved, though unfortunately the distal extremity is missing. It is rather a slender, elongated bone, and is unlike the humerus of any form hitherto described except the imperfectly known humerus of *Theriodesmus*. Unfortunately in *Theriodesmus* the humerus is only known from a mould of the upper and lower ends, and so imperfect are the impressions that Seeley* was originally led to the conclusion that the remains were those of a mammal, though he † afterwards recognised them to belong to a

* H. G. Seeley, "On Parts of the Skeleton of a Mammal from Triassic Rocks, &c.," *Phil. Trans.*, 1888, p. 141.

† H. G. Seeley, "The Reputed Mammals from the Karroo Formation of Cape Colony," *Phil. Trans.*, 1895, p. 1019.

Theriodont. The humerus in *Ictidosuchus*, like that in *Theriodesmus*, in its general proportions seems more mammal-like than any other of the known Theriodont humeri. The upper part of the humerus bears some resemblance to that in *Gomphognathus*, but the radial crest passes less directly outward from the bone than in that genus, and forms a deeper concavity on its inner side. As in *Gomphognathus*, the radial crest arises rather abruptly near the middle of the bone, and is not continued down as in *Cynodraco* to strengthen the bridge over the entepicondylar foramen—the bone between the lower end of the radial crest and the upper end of the bridge being almost quite round. The entepicondylar foramen is fairly large, and is much more proximally situated than in *Gomphognathus*. Though the distal extremity is missing, from what remains it is manifest that there must have been a very small external condyle, though the internal condyle may have been moderately large.

RADIUS.

The radius is somewhat crushed, and the extremities not very perfect. In its general proportions it agrees fairly well with that in *Theriodesmus*. It is about 70 mm. in length.

FEMUR.

The femur is fairly well preserved, and is unlike any femur hitherto found. Unfortunately the head is lost; but though the lower part is somewhat fragmentary, the fragments can all be fitted in true apposition. In the middle region the femur is fairly round and small, but it becomes greatly expanded at each end. The upper end has a large trochanter major, immediately below which on the front of the femur is a large deep oval depression, about as wide as the femur is at its middle, and almost as deep as it is wide. The bottom of this concavity is rounded and smooth. I am not aware of a similar concavity having been found previously in the femur of any Theriodont, but a distinct though much less marked concavity is found in the corresponding part of the femur of *Dicynodon*; and among mammals a quite distinct depression below the trochanter major occurs in *Ornithorhynchus* and *Echidna*. So far as the femur is displayed no trochanter minor is to be seen. Near the junction of the upper $\frac{3}{5}$ with the lower $\frac{2}{5}$ the femur begins to expand out towards the distal end, and as it broadens out it becomes transversely concave. The axis of the lower part is also bent slightly backwards and inwards, so that the lower part of the femur looks slightly outwards. The condyles are apparently situated mainly below the outer part of the

expanded lower end, so that the inner side of the concave lower end is really an anteriorly directed ridge, which stands prominently out from the femur.

TIBIA AND FIBULA.

The tibia is fairly well preserved, but only a portion of the fibula remains. The tibia is a moderately long bone of fairly uniform thickness, considerably expanded at its upper end and slightly at its lower. It resembles the tibia in Marsupials in being flattened laterally. Near the union of the middle with lower third the axis of the bone is bent slightly backwards. The fibula near the middle is about half the thickness of the tibia, but at its lower end it becomes considerably expanded.

VERTEBRÆ.

One or two vertebræ have been found, but not in a very satisfactory condition. The bodies of the vertebræ are biconcave, but not very deeply cupped, and the arches remain united with the bodies only by suture. The length of the body is one of the best preserved, and probably a dorsal vertebra is 15 mm.

UNDETERMINED ELEMENTS.

Two moderately well-preserved bones I have thought it advisable to figure, though I cannot venture on an opinion as to what they are. The first is a somewhat triangular little bone, from one angle of which passes out a long, delicate, perfectly flat bony process. This process has evidently lain alongside of some element which fitted into a deep groove on the same side of the triangular bone as the process; and the element which has fitted into the groove has been held in position by an overlapping plate of the triangular element.

The other bone is moderately flat, and has passing out on one side also a long bony process, but a slightly twisted one.

As there is no evidence as to the relations of these bones, I think it inadvisable to speculate as to what they may be.

CONCLUSIONS.

From the examination of the various remains of *Ictidosuchus* it will be seen that, though the form is a Theriodont, it differs very considerably from most known Theriodonts, and in a number of points shows affinities with the Anomodonts, and it is not improbable that it may belong to that group of primitive Theriodonts from which *Dicynodon* and its allies appear to have sprung.

Ictidosuchus is probably allied to *Theriodesmus*, but the structure of the tibiæ shows the two genera to be quite distinct.

PLATES XXVI. AND XXVII.

ALL THE FIGURES ARE NATURAL SIZE.

PLATE XXVI.

FIG.

1. Upper side of skull of *Ictidosuchus primævus*.
2. Side view of skull and lower jaw. The fragment of the maxilla with the canine tooth is in true apposition. The squamosal is restored from that of the right side. The upper molars are somewhat crushed together.

PLATE XXVII.

3. Side view of left shoulder girdle. The upper part of the scapula is much curved, and consequently fore-shortened in the drawing.
4. Front view of right humerus.
5. Inner view of right humerus.
6. Front view of left femur. The lower portion of the femur is figured in true position.
7. Outer view of left tibia. The tibia is practically complete, but as the lower part is in a different block and has its inner side displayed it is merely figured in outline.
- 8, 9. Undetermined elements.